April 18, 1961 J. H. NULTON, JR., ET AL 2,980,766

BALANCE INDICATOR FOR STEREOPHONIC SOUND SYSTEMS

Filed Jan. 19, 1959 2 Sheets-Sheet 1

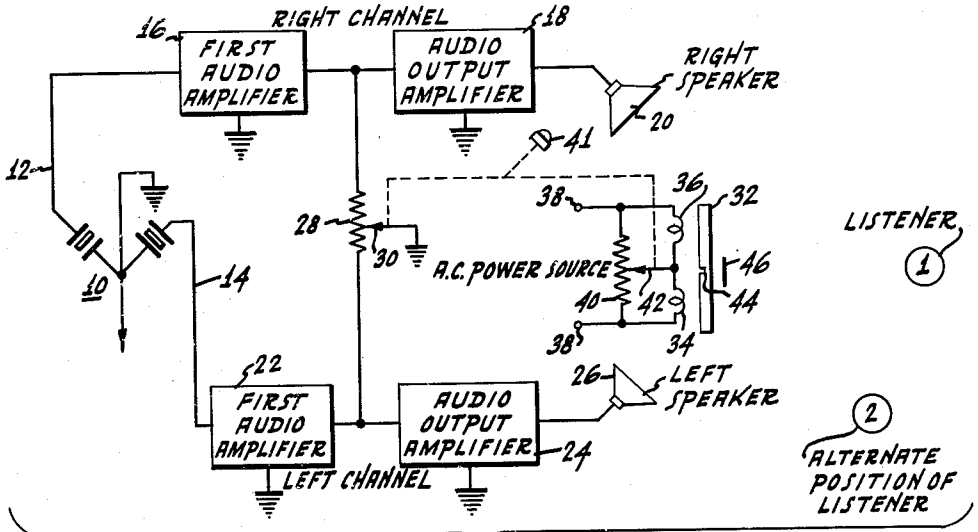


Fig. 1.

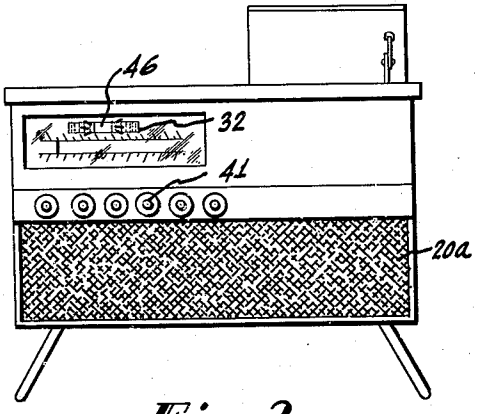


Fig. 2.

Fig. 3.

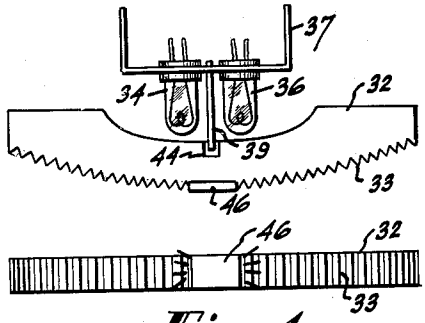


Fig. 4.

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BALANCE INDICATOR FOR STEREOPHONIC SOUND SYSTEMS

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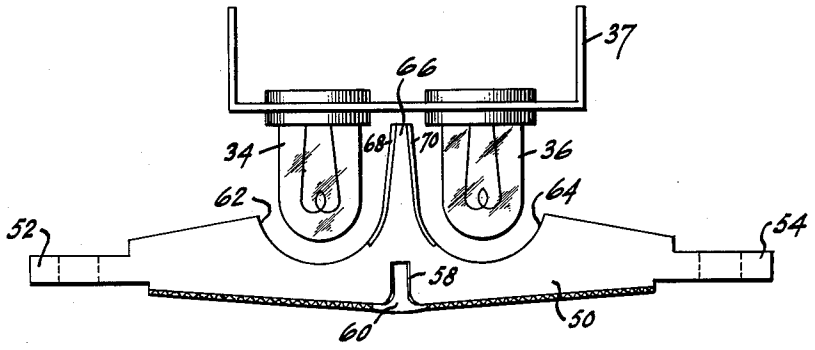


Fig. 5.

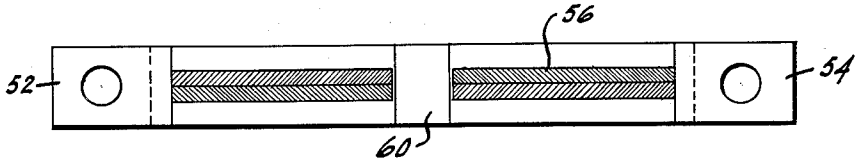


Fig. 6.

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BALANCE INDICATOR FOR STEREOPHONIC SOUND SYSTEMS

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7 Claims. (Cl. 179—1)

This invention relates to balance indicators for stereophonic sound systems and, more particularly, to a system which provides a visual indication of the apparent balance or unbalance between the response of the separate sound channels of a stereophonic sound system.

Stereophonic sound systems includes at least two separate amplifier channels for amplfying the signals which drive the right and left and, in some cases, additional loudspeaker systems. Most stereophonic amplifying systems include a balance control for adjusting the driving signal level or gain of one signal relative to that of the other so that sound reaching the listener from each of two loudspeaker systems respectively driven by the separate amplifier channels appears to be balanced. The term "balance" as used herein indicates that the sound output of the two loudspeaker systems is equal for the same signal input to both channels. "Apparent balance" as used herein indicates that the sound reaching the listener from the two loudspeaker systems is equal for the same signal input to both channels although, in cases where the listener is nearer one speaker than the other, the sound output from the latter speaker is greater than that of the former.

Stereophonic signals amplified in the two channels differ, and it is not uncommon to have a relatively large driving signal in one channel with a relatively small driving signal in the other. It is, therefore, difficult to judge by the sound output from the two loudspeaker systems when the balance control is at the proper setting. Accordingly, it is desirable to provide some means for indicating when the two signal channels of the system are balanced.

One problem encountered in the provision of a balance indicating system is that the apparent balance is a function of the position of the listener with respect to the two loudspeakers. Thus, when the listener is closer to one of the loudspeakers, the ratio of the signal drive between the two loudspeakers must be changed so that the farther speaker is driven harder than the nearer one to maintain the system in apparent balance.

It is an object of this invention to provide a balance indicating system for stereophonic sound systems.

It is another object of this invention to provide an improved indicating system for stereophonic sound systems which provides an indication of the apparent balance or unbalance between the signal channels of a stereophonic sound system that can be easily read and understood by a listener located several feet from the indicator.

A further object of this invention is to provide a simple and inexpensive balance indicator for stereophonic sound reproducing systems which provides a visual indication of apparent balance or unbalance between the

stereophonic sound reproducers without regard to the particular location of the listener with respect to the two loudspeaker systems.

In accordance with the invention, a pair of electric lamps are positioned behind a translucent lens. A variable energizing voltage source is connected to the lamps in a manner such that the voltage to one lamp is increased as the voltage to the other is decreased. The energizing voltage control element is ganged with the balance control so that for apparent balance, the lamps produce a composite bright luminous area concentrated near the center of the lens.

The novel features which are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawing, in which:

Figure 1 is a schematic circuit diagram partly in block form of a stereophonic phonograph system incorporating the balance indicator of the invention;

Figure 2 is a front view of a stereophonic radio-phonograph console including the balance indicator of the invention;

Figures 3 and 4 are top and front views respectively of the indicator portion of the indicating system of the invention; and

Figures 5 and 6 are top and front views respectively of a modification of the indicator portion of the indicating system of the invention.

Referring to the drawings and particularly to Figure 1, the stereophonic phonograph system includes a stereophonic pickup or transducer **10** which is adapted to generate a pair of electrical signals corresponding to the stereophonically related recordings of a stereophonic phonograph record, not shown. The stereophonic signal source could be derived from any suitable source such as a stereophonic tape recording head or a stereophonic radio signal receiver.

One of the stereophonically related signals from the transducer **10** is applied by way of a conductor **12** to the right hand channel of the phonograph system which includes a first audio amplifier **16**, an audio output amplifier **18** and a loudspeaker **20**. The other of the stereophonic signals from the transducer **10** is applied through the conductor **14** to the left hand channel of the phonograph apparatus which includes a first audio amplifier **22**, an audio output amplifier **24** and a loudspeaker **26**. The right and left loudspeakers **20** and **26**, which may comprise loudspeaker systems each including several individual sound reproducing devices, are preferably spaced apart by several feet.

To control the balance or apparent balance between the right and left hand signal channels, a resistor **28** is connected between the input terminals of the audio output amplifiers **18** and **24**. The resistor **28** is provided with a movable tap **30** which is connected to signal ground. As the tap is moved toward the end of the resistor **28** which is connected to the amplifier **18** the signal level applied to that amplifier is decreased, and the signal level applied to the amplifier **24** is increased. Conversely, movement of the tap **30** toward the end of the resistor **28** connected to the amplifier **24** increases the signal level applied to the amplifier **18** and decreases the signal level applied to the amplifier **24**.

The balance indicating system of the invention includes

a translucent lens 32 behind which is positioned a pair of illuminating devices such as filamentary lamps 34 and 36. Energizing voltages for the lamps 34 and 36 are derived from a variable resistor 40 which is connected across the terminals 38 of an A.C. power source. The resistor 40 includes a movable tap 42 which is ganged for unicontrol operation with the tap 30 on the balance control resistor 28. The lamps 34 and 36 are respectively connected between opposite ends of the resistor 40 and the movable tap 42. Thus, as the tap 42 is moved upwardly as shown in Figure 1, less voltage is applied to the lamp 36 and more voltage is applied to the lamp 34 causing the lamp 36 to dim and the lamp 34 to brighten.

As shown in Figures 3 and 4, the lens 32 has a generally arcuate front surface with a plurality of notches 33. The panel may be fabricated of any translucent material which provides a degree of diffusion of the light passed therethrough. By way of example it has been found that a tinted luminescent acrylic material provides a particularly pleasing optical effect. It is desirable to mask the top and bottom surfaces of the lens 32 to prevent light from entering the panel therethrough. The lamps 34 and 36 are mounted on a bracket 37 which also supports an opaque shield 39 that extends into the notch 44 on the translucent lens 32. The effect of the notch 44 and the shield 39 is to reduce the amount of light transfer from one side of the lens 32 to the other so that the light produced by the lamp 34 produces the predominate illuminating effect of the left side of the lens and the light from the lamp 36 produces the predominate illuminating effect on the right side of the lens 32. A second opaque shield 46 covers the center portion of the panel so that direct radiation from the lamps through the lens 32 is reduced.

The lamps produce a bright luminous area on the front surface of the lens 32 which appears to move back and forth as the tap 42 is moved in one direction or the other along the resistor 42. This illusion of lateral motion is enhanced by the action of the shield 46 which blocks direct radiation from the lamps through the lens 32. The notches or grooves 33 in the front surface of the lens 32 can be used as indicating lines to gauge the position of the luminous area and thereby simplify the centering of the luminous area on either side of the shield 46.

As shown in Figure 1, the indicator panel is positioned midway between the loudspeakers 20 and 26. If desired, however, the indicator panel may be mounted directly on the cabinet for one of the speakers. For example, Figure 2 shows an AM-FM radio phonograph console including the indicator lens 32 mounted immediately above the AM-FM tuning dial. The console cabinet also houses the amplifiers, record player and one of the two speaker systems. In the console shown, the speaker system 20*a* is located in the lower half of the cabinet. It will be noted that one of the control knobs 41, on the front panel of the cabinet is the balance control, and is ganged with the taps 30 and 42 on the resistors 28 and 40 respectively.

The tap 30 on the resistor 28 and the tap 42 on the resistor 40 are initially adjusted so that the stereophonic sound system is in apparent balance when the bright luminous area appears centered on the lens 32. When the listener stands in the position indicated by the numeral 1, in Figure 1, and adjusts the balance control for the stereophonic sound system, the right and left hand channels will be balanced when the light emanating from either side of the shield 46 is equal.

If the listener moves to an alternate position indicated by the numeral 2, without any adjustment of the balance control, more light will then appear to come from the left hand side of the balance indicator. This indicates that the system is not in apparent balance for listener position 2, and that the left speaker 26 is driven too hard relative to the speaker 20. This is to be expected because a listener at position 2 is closer to the left speaker 26 than to the right speaker 20. To adjust the system to a condition of apparent balance for the listener at location 2, the balance control is adjusted to move the taps 30 and 42 until an equal amount of light appears to come from both sides of the shield 46. To accomplish this, the tap 42 must be moved downwardly, as shown in Figure 1, to provide a greater voltage across the lamp 36 and less across the lamp 34. However, at the same time the tap 30 is also moved downwardly so that less signal is applied to the amplifier 24 and more to the amplifier 18. At the proper position of the balance control the sound reaching the listener at the alternate position 2 will be equal from both speakers 20 and 26, and a bright luminous area will appear concentrated at the center of the translucent lens 32, equally distributed on both sides of the shield 46.

Figures 5 and 6 illustrate a modification of the indicator shown in Figures 3 and 4 of the drawings. In this embodiment of the invention the light shield between the lamps 34 and 36 comprises an integral part of the lens 50. The lens 50 comprises an elongated translucent panel having a pair of end portions 52 and 54 which include apertures for receiving a fastening device to mount the lens on a supporting panel. The lens has a front viewing surface 56 which includes a plurality of shallow grooves arranged in a herring-bone pattern directed away from the center of the lens. A vertical groove 58 is provided in the front viewing surface 56 for receiving an opaque light shield 60 which has an opaque rearwardly extending portion which tends to prevent light from the right and left hand lamps 36 and 34, respectively, from entering the opposite sides of the lens 50. As mentioned before in connection with Figures 3 and 4, the shield 60 enhances the illusion of lateral motion of the luminous area appearing on the front viewing surface 56 of the lens when the illumination from one of the lamps is increased as the other is decreased.

The rear surface of the lens 50 is provided with a pair of arcuate cut-out portions 62 and 64 separated by a rearwardly extending projection 66. The cut-out portions 62 and 64 are dimensioned for receiving in close proximity thereto the forward ends of the lamps 34 and 36 respectively. The surfaces of the rearwardly extending projection 66 are coated or otherwise covered with opaque black coatings 68 and 70 which tend to restrict the illumination of the lamp 34 to the left hand side of the lens 50 and illumination from the lamp 36 to the right hand side of the lens 50. The operation of the balance indicator structure shown in Figures 5 and 6 is substantially the same as that described above in connection with Figures 1 to 4.

We claim:

1. A balance indicator for stereophonic sound system of the type including a pair of signal channels for driving right and left hand horizontally spaced sound reproducing devices respectively and including balance control means for adjusting the relative sound output from said sound reproducing devices for the same signal input to said signal channels, comprising an elongated luminescent acrylic lens having a generally arcuate front viewing surface positioned with its longitudinal axis in a horizontal plane, the front viewing surface of said lens having a plurality of closely spaced serrations distributed along the length thereof, the rear surface of said lens having a projection normal to the longitudinal axis of said lens at the center thereof, a pair of electric lamps positioned along said longitudinal axis behind said lens, one immediately to the right and the other to the left of said projection, means providing an opaque light shield over said projection to permit light from each of said lamps to enter said lens from only one side thereof, a second opaque shield positioned over the center portion of said front viewing surface, a control voltage source, voltage control means for applying voltages

from said source to said lamps in such manner that the voltage to one lamp is increased as the voltage to the other lamp is decreased, said voltage control means being adjusted so that for apparent balance between said right and left hand sound reproducing devices a luminous area appears on the front viewing surface of said lens extending substantially equal distances on both sides of said second opaque shield, and means for mechanically ganging said voltage control means with said balance control means so that adjustment of said balance control means in a direction to increase the output of the right sound reproducing device relative to that of the left, also increases the voltage applied to the right lamp and decreases the voltage applied to the left lamp, and adjustment of said balance control means in a direction to increase the output of the left sound reproducing device relative to that of the right, also increases the voltage applied to the left lamp and decreases the voltage applied to the right lamp.

2. A balance indicator for a stereophonic sound system of the type including a pair of signal channels for driving right and left hand horizontally spaced sound reproducing devices respectively and including balance control means for adjusting the relative sound output from said sound reproducing devices for the same signal input to said signal channels, comprising an elongated translucent luminescent acrylic lens having a generally arcuate front viewing surface positioned with its longitudinal axis in a horizontal plane, the front viewing surface of said lens having a plurality of closely spaced vertical serrations along the length thereof, a pair of electric lamps positioned along said longitudinal axis behind and immediately to the right and left of center of said lens, a vertical notch in the center of the rear surface of said lens, an opaque shield positioned between said lamps and extending into said notch, a second opaque shield positioned over the center portion of said front viewing surface, a control voltage source, voltage control means for applying voltages from said source to said lamps in a manner that the voltage to one lamp is increased as the voltage to the other lamp is decreased, said voltage control means being adjusted so that for apparent balance between said right and left hand sound reproducing devices a luminous area appears on the front viewing surface of said lens extending substantially equal distances on both sides of said second opaque shield, and means for mechanically ganging said voltage control means with said balance control means so that adjustment of said balance control means in a direction to increase the output of the right sound reproducing device relative to that of the left, also increases the voltage applied to the right lamp and decreases the voltage applied to the left lamp, and adjustment of said balance control means in a direction to increase the output of the left sound reproducing device relative to that of the right, also increases the voltage applied to the left lamp and decreases the voltage applied to the right lamp.

3. A balance indicator for a stereophonic sound system of the type including a pair of signal channels for driving right and left horizontally spaced sound reproducing devices respectively and including balance control means for adjusting the relative sound output from said sound reproducing devices for the same signal input to said signal channels, comprising an elongated translucent lens having a front viewing surface positioned with the longitudinal axis thereof in a horizontal plane, a pair of electric lamps positioned along said longitudinal axis behind and to the right and left of center of said lens, an opaque shield positioned over the center portion of said front viewing surface, energizing control means for said lamps for simultaneously increasing the illumination from one lamp as the illumination from the other lamp is decreased, said energizing control means being adjusted so that for apparent balance between said right and left hand speakers a luminous area appears at the center of the front viewing surface of said lens extending substantially equal distances on both sides of said opaque shield, and means for ganging said energizing control means with said balance control means so that adjustment of said balance control in a direction to increase the output of the right sound reproducing device relative to that of the left, also increases the illumination from the right lamp and decreases the illumination from the left lamp and, adjustment of said balance control in a direction to decrease the output of the right sound reproducing device relative to that of the left, also decreases the illumination from the right lamp and increases the illumination from the left lamp.

4. A balance indicator for a stereophonic sound system of the type including a pair of signal channels for driving right and left hand horizontally spaced sound reproducing devices respectively and including balance control means for adjusting the relative sound output from said sound reproducing devices for the same signal input to said signal channels, comprising an elongated translucent lens having a front viewing surface positioned with the longitudinal axis thereof extending horizontally, a pair of illuminating devices positioned along said longitudinal axis behind and to the right and left of center of said lens, energizing control means for energizing said lamps in a manner to increase the illumination of one lamp relative to that of the other, said energizing control means being adjusted so that for apparent balance between said right and left hand speakers a luminous area appears at the center of the front viewing surface of said lens, and means for ganging said energizing control means with said balance control means so that adjustment of said balance control in a direction to increase the output of the right sound reproducing device relative to that of the left, also increases the illumination from the right lamp relative to that of the left lamp and, adjustment of said balance control in a direction to decrease the output of said right sound reproducing device relative to that of the left, also decreases the illumination from the right lamp relative to that of the left lamp.

5. A balance indicator for a stereophonic sound system of the type including a pair of signal channels and a balance control means for adjusting the driving signal level of one of said channels relative to the other, comprising a translucent lens, a pair of electric lamps positioned behind said lens, an energizing voltage source for said lamps, control means for simultaneously increasing the voltage to one of said lamps and decreasing the voltage to the other of said lamps, and means for ganging said control means for unicontrol operation with said balance control means.

6. A balance indicator for a stereophonic sound system of the type including a pair of signal channels and a balance control means for adjusting the driving signal level of one of said channels relative to the other, comprising means providing a translucent viewing screen, means providing an optical system including a light source behind said screen for producing a discrete luminous area on said screen, control means for adjusting said optical system to control the position of said luminous area on said screen, and means for ganging said control means for unicontrol operation with said balance control means.

7. A balance indicator for a stereophonic sound system of the type including a pair of signal channels for driving right and left hand horizontally spaced sound reproducing devices respectively and including balance control means for adjusting the relative sound output from said sound reproducing devices for the same signal input to said signal channels, comprising means providing an elongated viewing surface positioned with the longitudinal axis thereof in a horizontal plane, means providing an optical system including a light source po-

sitioned behind said viewing surface for producing a discrete luminous area on said viewing surface, control means for said optical system to control the position of said luminous area on said screen, said optical system control means being adjusted so that for apparent balance between said right and left hand speakers said luminous area appears at the center of said viewing surface, said optical system control means being responsive to the setting of said balance control means so that ad-

justment of said balance control in a direction to increase the output of the right sound reproducing device relative to that of the left causes said luminous area to move to the right, and adjustment of said balance control in a direction to increase the output of the left sound reproducing device relative to that of the right causes said luminous area to move to the left.

No references cited.